

Bay Head School	
Content Area: Mathematics Course Title: Algebra	Grade Level: Eighth Grade/Algebra
Unit Plan 1 Seeing Structure in Expressions	40 days Ongoing
Unit Plan 2 Arithmetic with Polynomials and Rational Expressions	30 days Ongoing
Unit Plan 3 Creating Equations	60 days Ongoing
Unit Plan 4 Reasoning with Equations and Inequalities	50 days Ongoing
Updated: August 2018 by Sharon Carroll	Board Approved:

Standards for Mathematical Practice	
<i>The following standards for mathematical practice should be incorporated in all units.</i>	
MP.1 Make sense of problems and persevere in solving them.	Find meaning in problems Look for entry points Analyze, conjecture and plan solution pathways Monitor and adjust Verify answers Ask themselves the question: "Does this make sense?"

<p>MP.2 Reason abstractly and quantitatively.</p>	<p>Make sense of quantities and their relationships in problems Learn to contextualize and decontextualize Create coherent representations of problems</p>
<p>MP.3 Construct viable arguments and critique the reasoning of others.</p>	<p>Understand and use information to construct arguments Make and explore the truth of conjectures Recognize and use counterexamples Justify conclusions and respond to arguments of others</p>
<p>MP 4 Model with mathematics.</p>	<p>Apply mathematics to problems in everyday life Make assumptions and approximations Identify quantities in a practical situation Interpret results in the context of the situation and reflect on whether results make sense</p>
<p>MP.5 Use appropriate tools strategically</p>	<p>Consider the available tools when solving problems Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website and other technological tools) Make sound decisions of which of these tools might be helpful</p>
<p>MP.6 Attend to precision.</p>	<p>Communicate precisely to others Use clear definitions, state the meaning of symbols and are careful specifying units of measure and labeling axes Calculate accurately and efficiently</p>
<p>MP.7 Look for and make use of structure</p>	<p>Discern patterns and structures Can step back for an overview and shift perspective See complicated things as single objects or as being composed of several objects</p>
<p>MP.8 Look for and express regularity in repeated reasoning.</p>	<p>Notice if calculations are repeated and look for both general methods and shortcuts. In solving problems, maintain oversight of the process while attending to detail Evaluate the reasonableness of their immediate results</p>

**Bay Head School
MATHEMATICS CURRICULUM
Unit Overview**

Content Area: Mathematics

Grade Level: Eighth Grade/Algebra

Domain (Unit Title): Seeing Structure in Expressions

Cluster: A-SSE

Cluster Summary:

- Interpret the structure of expressions
- Write expressions in equivalent forms to solve problems

Primary Interdisciplinary Connections:

Science	measurement (distance, weight, and growth), data analysis and collection, experiments relating to Energy, Earth and Human Activity and Engineering and Design .
Social Studies	economics & money, weather patterns, geography & map skills, and graphing
Language Arts	math journals, word problem comprehension, math stories, open-ended math questions, multi-step problems, math literature
Technology	Students will be able to use a graphing calculator to graph a function, set the window range, create scatter plots and use the regression feature including calculating the correlation coefficient, and solve a linear system by finding the point of intersection.

21st Century Themes:

Global Awareness

N-Q.1

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units

	consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
N-Q.2	Define appropriate quantities for the purposes of descriptive modeling.
N-Q.3	Choose a level of accuracy appropriate to limitations on measurements when reporting quantities.

College and Career Readiness

Mathematics programs develops a deep understanding of mathematics by building a strong foundation of number sense at the elementary level before moving into more advanced content. Students will learn to make sense of problems and persevere in problem solving, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of a structure, and look for and express regularity in repeated reasoning.

Learning Targets

Content Standards: A-SSE

Number	Standard for Mastery
A.SSE.1	Interpret expressions that represent a quantity in terms of its context. <ul style="list-style-type: none"> A. Interpret parts of an expression, such as terms, factors, and coefficients. B. Interpret complicated expressions by viewing one or more of their parts as a single entity. <i>For example, interpret $P(91+r)$ as the product of P and a factor not depending on P.</i>
A.SSE.2	Use the structure of an expression to identify ways to rewrite it. <i>For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$</i>
A.SSE.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. <ul style="list-style-type: none"> A. Factor a quadratic expression to reveal the zeros of the function it defines. B. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines. C. Use the properties of exponents to transform expressions for exponential functions. <i>For example the expression 1.15 can be rewritten as $(1.15^{1/12})^{12} \approx 1.012^{12}$ to reveal the approximate</i>

	<i>equivalent monthly interest rate if the annual rate is 15%</i>
A-SSE.4	Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems. <i>For example, calculate mortgage payments.</i>

<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How can you use properties of exponents to produce equivalent forms of exponential expressions in one variable? • How can you use factoring and completing the square to produce equivalent forms of quadratic expressions in one variable that highlight particular properties such as the zeros or the maximum or minimum value of the function? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • Interpret terms, factors, coefficients, and other parts of expressions in terms of a context • Complete the square for the purpose of revealing the maximum or minimum of a function
--	--

<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • How to Interpret terms, factors, coefficients, and other parts of expressions in terms of a context • 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Interpret expressions for functions in terms of the situation • Identify different parts of an expression, including terms, factors and constants • Explain the meaning of parts of an expression in context • Use the properties of exponents to simplify or expand exponential expressions, recognizing these are equivalent forms • Factor a quadratic expression for the purpose of revealing the zeros of a function
---	--

--	--

**Bay Head School
MATHEMATICS CURRICULUM
Unit Overview**

Content Area: Mathematics **Grade Level:** Eighth Grade - Algebra

Domain (Unit Title): Arithmetic with Polynomials and Rational Expressions

Cluster: A-APR

- Cluster Summary:**
- Perform arithmetic operations on polynomials
 - Understand the relationship between zeros and factors of polynomials
 - Use polynomial identities to solve problems
 - Rewrite rational expressions

Primary Interdisciplinary Connections:

Science	measurement (distance, weight, and growth), data analysis and collection
Social Studies	economics & money, weather patterns, geography & map skills, and graphing
Language Arts	math journals, word problem comprehension, math stories, open-ended math questions, multi-step problems, math literature
Technology	8.1- Educational Technology: use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. interactive whiteboard lessons, independent centers, classroom websites, online resources and apps

21st Century Themes:

Global Awareness	Students work with word problems containing names of people and locations around the world.
Communication and Collaboration	Students use mathematical arguments to articulate thoughts and ideas with peers and teachers
Critical Thinking and Problem Solving	Students use various types of reasoning as appropriate to solve a mathematical problem.

College and Career Readiness

Mathematics programs develops a deep understanding of mathematics by building a strong foundation of number sense at the elementary level before moving into more advanced content. Students will learn to make sense of problems and persevere in problem solving, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of a structure, and look for and express regularity in repeated reasoning.

Learning Targets

Content Standards: A-APR

Number	Standard for Mastery
A.APR.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
A.APR.2	Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x - a$ is $p(a)$, so $p(a) = 0$ if and only if $(x - a)$ is a factor of $p(x)$.
A.APR.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
A.APR.4	Prove polynomial identities and use them to describe numerical relationships. <i>For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.</i>
A.APR.5	(+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of x and y for a positive integer n , where x and y are any numbers, with coefficients determined for example by Pascal's Triangle.

A.APR.6	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.
A.APR.7	(+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.

<p>Unit Essential Questions</p> <ul style="list-style-type: none"> • How do we compare the differences between linear and exponential growth? • How can we apply the concept of exponential growth/decay to real world problems? • How are geometric sequences related to exponential functions/ • When do quantities have a nonlinear relationship? • How do we interpret the structure of expressions? 	<p>Unit Enduring Understandings <i>Students will understand that...</i></p> <ul style="list-style-type: none"> • There can still be a relationship between two numbers even if there is no linear pattern. • Predictions can be made using exponential growth and decay models. • Scientific notation can be used to represent extremely large or extremely small numbers. • Expressions involving exponents may be simplified by applying the laws of exponents.
--	--

<p>Unit Objectives <i>Students will know...</i></p> <ul style="list-style-type: none"> • How to simplify exponents using the laws of exponents. • Scientific notation is primarily used to write very small or very large numbers. • How to recognize a growth or decay exponential equation or graph. • How to relate geometric sequences to exponential 	<p>Unit Objectives <i>Students will be able to...</i></p> <ul style="list-style-type: none"> • Multiply and divide monomials using the properties of exponents. • Evaluate and rewrite expressions involving rational exponents. • Find products and quotients of numbers expressed in scientific notation. • Graph exponential functions. • Solve problems involving exponential growth or decay.
--	--

<p>functions.</p>	<ul style="list-style-type: none"> ● Perform arithmetic operations on polynomials ● Identify and generate geometric sequences. ● Write exponential equations that model real-world growth and decay data ● Observe exponential growth using tables and graphs
-------------------	---

**Bay Head School
MATHEMATICS CURRICULUM
Unit Overview**

Content Area: Mathematics **Grade Level:** Eighth Grade/Algebra

Domain (Unit Title): Creating Equations

Cluster: A-CED

Cluster Summary:

- Create equations that describe numbers or relationships

Primary Interdisciplinary Connections:

Science	measurement (distance, weight, and growth), data analysis and collection
Social Studies	economics & money, weather patterns, geography & map skills, and graphing
Language Arts	math journals, word problem comprehension, math stories, open-ended math questions, multi-step problems, math literature
Technology	8.1- Educational Technology: use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. interactive whiteboard lessons, independent centers, classroom

	websites, online resources and apps
--	-------------------------------------

21st Century Themes:

Global Awareness	Students work with word problems containing names of people and locations around the world to develop understanding of diverse cultures and lifestyles.
Communication and Collaboration	Students use mathematical arguments to articulate thoughts and ideas with peers and teachers

College and Career Readiness

Mathematics programs develops a deep understanding of mathematics by building a strong foundation of number sense at the elementary level before moving into more advanced content. Students will learn to make sense of problems and persevere in problem solving, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of a structure, and look for and express regularity in repeated reasoning.

Learning Targets

Content Standards: A-CED

Number	Standard for Mastery
A.CED.1	Create equations and inequalities in one variable and use them to solve problems. <i>Include equations arising from linear and quadratic functions, and simple rational and exponential functions.</i>
A.CED.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales
A.CED.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context. <i>For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.</i>

A.CED.4

Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law $V = IR$ to highlight resistance R .*

Unit Essential Questions

- Which representation of a pattern more clearly shows whether or not the pattern is linear: a table of values or a graph of the pattern?
- Are all functions linear? Are all lines functions?
- What do you expect to see in this graph given its equations?
- How do equations and inequalities describe relationships?

Unit Enduring Understandings

Students will understand that...

- Students will model real-life data with equations and graphs and will be able to interpret what is shown.
- Students will compare graphs and analyze the corresponding tables to understand why the graphs are as they are.
- Students will be able to make predictions about graphs based on the equations/tables that correspond to them.
- Solve linear equations with coefficients represented by letters in one variable.

Unit Objectives

Students will know...

- Determine whether a relation is a function.
- Complete function tables.
- Represent linear functions using tables and graphs.
- Identify proportional and non-proportional linear relationships by finding a constant rate of change.
- Find rate of change.
- Find slope of a line.
- Use direct variation to solve

Unit Objectives

Students will be able to...

- Determine if relations are functions.
- Understand the rules of functions.
- Analyze the change in x-value and how it changes the y-value.
- Compare functions in their different forms (tables, graphs, and equations).
- Describe functional relationships (linear vs. nonlinear).
- Translate verbal expressions to create function equations.
- Graph equations in two variables

<p>problems.</p> <ul style="list-style-type: none"> • Graph linear equations using slope and y-intercept. • Use technology to investigate situations to determine if they display linear behavior. • Graph and analyze slope triangles. 	<p>by making a table of values and plotting points.</p> <ul style="list-style-type: none"> • Interpret unit rate as slope. • Understand slope-intercept form and its components. • Interpret $y = mx + b$ as a linear function. • Graph an equation using the slope and y-intercept. • Write an equation from the given graph using the slope and y-intercept.
--	--

<p style="text-align: center;">Bay Head School MATHEMATICS CURRICULUM Unit Overview</p>	
<p>Content Area: Mathematics</p>	<p>Grade Level: Eighth Grade - Algebra</p>
<p>Domain (Unit Title): Reasoning with Equations and Inequalities</p>	
<p>Cluster: A-REI</p>	
<p>Cluster Summary:</p> <ul style="list-style-type: none"> • Understand solving equations as a process of reasoning and explain the reasoning • Solve equations and inequalities in one variable • Solve systems of equations • Represent and solve equations and inequalities graphically 	

Primary Interdisciplinary Connections:

Science	measurement (distance, weight, and growth), data analysis and collection, experiments relating to Waves, Earth's Place in the Universe and Earth's Systems .
Social Studies	economics & money, weather patterns, geography & map skills, and graphing
Language Arts	math journals, word problem comprehension, math stories, open-ended math questions, multi-step problems, math literature
Technology	8.1- Educational Technology: use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge. interactive whiteboard lessons, independent centers, classroom websites, online resources and apps

21st Century Themes:

Global Awareness	Students work with word problems containing names of people and locations around the world to develop understanding of diverse cultures and lifestyles.
Communication and Collaboration	Students use mathematical arguments to articulate thoughts and ideas with peers and teachers

College and Career Readiness

Mathematics programs develops a deep understanding of mathematics by building a strong foundation of number sense at the elementary level before moving into more advanced content. Students will learn to make sense of problems and persevere in problem solving, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, model with mathematics, use appropriate tools strategically, attend to precision, look for and make use of a structure, and look for and express regularity in repeated reasoning.

Learning Targets

Content Standards: REI

Number	Standard for Mastery
A.REI.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
A.REI.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.
A.REI.3	Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
A.REI.4	<p>Solve quadratic equations in one variable.</p> <p>A. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.</p> <p>B. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.</p>
A.REI.5	Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.
A.REI.6	Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.
A.REI.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.</i>
A.REI.8	(+) Represent a system of linear equations as a single matrix equation in a vector variable.
A.REI.9	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3×3 or greater).
A.REI.10	Understand that the graph of an equation in two variables is the set of

	all its solutions plotted in the coordinate plane, often forming a curve (which could be a line)
A.REI.11	Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
A.REI.12	Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

Unit Essential Questions

- How can systems of equations be solved graphically?
- How are systems of equations be solved exactly (algebraically) and approximately (graphically)?

Unit Enduring Understandings

Students will understand that...

- $Y = f(x)$, $y = g(x)$ represent a system of equations
- There are multiple methods for solving quadratic equations
- Transforming a quadratic equation into the form $(x-p)^2 = q$ yields an equation having the same solutions

Unit Objectives

Students will know...

- Systems of equations can be solved algebraically (exactly) and graphically (approximately)
- Solve quadratic equations in one variable using a variety of methods
- Derive the quadratic formula by completing the square and recognize when there were no real solutions

Unit Objectives

Students will be able to...

- Explain the relationship between the x-coordinate of a point of intersection and the solution to the equation
- Solve systems of linear equations using the elimination or substitution method
- Interpret the solution(s) in context
- Model real world situations by creating a system of linear

	<p>inequalities given a context</p> <ul style="list-style-type: none"> • Approximate the solution (x) to a system of equations comprised of a linear and a quadratic function by using technology to graph the functions, by making a table of values and/or by finding successive approximations.
--	---

Evidence of Learning

<p>Suggested Formative Assessments:</p>	
<ul style="list-style-type: none"> • Teacher Observation • Performance Assessment • Exit Slips/Slate Assessment • Portfolios/Journals • Pre-Assessment 	<ul style="list-style-type: none"> • Games • Anecdotal Records • Oral Assessment/Conferencing • Daily Classwork

<p>Suggested Summative Assessments:</p> <ul style="list-style-type: none"> • Tests • Quizzes • National/State/District Assessments
--

<p>Suggested Modifications (ELLs, Special Education, Gifted and Talented):</p> <p>Low Level Strategies:</p> <ul style="list-style-type: none"> • Modified classroom and homework assignments • Teacher tutoring • Parent - teacher communication • Anchor charts and visual aids • Flexible grouping • Teacher - student goal setting • Technology integration • Centers • Response to intervention <p>High Level Strategies</p> <ul style="list-style-type: none"> • Multi-step and higher level math problems • Enrich problems • Extend activities
--

- Centers
- Student driven activities
- Student choice activities
- Peer tutoring

Suggested activities for lesson plans:

- <http://teachers.henr.co.k12.va.us/math/hcpsalgebra1>
- www.purplemath.com
- www.Kutasoftware.com
- www.Khanacademy.com
- www.mathworksheetsite.com
- www.studyisland.com
- www.brightstorm.com
- www.funbrain.com
- www.coolmath.com

Teacher Notes: